CERTIFICATION OF TRANSLATION

I, ***Seung-hye Kim***, an employee of Y.P.LEE, MOCK & PARTNERS of Koryo Bldg., 1575-1 Seocho-dong, Seocho-gu, Seoul, Republic of Korea, hereby declare under penalty of perjury that I understand the Korean language and the English language; that I am fully capable of translating from Korean to English and vice versa; and that, to the best of my knowledge and belief, the statement in the English language in the attached translation of ***Korean Patent Application No. 10-2003-0035559*** consisting of *22* pages, have the same meanings as the statements in the Korean language in the original document, a copy of which I have examined.

Signed this 26th day of November 2009

ABSTRACT

[Abstract of the Disclosure]

An apparatus for charging a battery of a portable electronic device connected to a computer by USB by receiving power from the computer through USB, the apparatus includes a control portion to generate charge control signals corresponding to a battery selected according to a battery selection signal that is externally input, and a charging portion to charge the selected battery according to the charge control signals from the control portion. According to the present invention, various types of batteries can be charged stably and efficiently by receiving power through USB in a method of charging various types of batteries included in the portable electronic device, such as lithium-ion, nickel metal hydride, or nickel cadmium, appropriate to their characteristics.

[Representative Drawing]

FIG. 7

SPECIFICATION

[Title of the Invention]

BATTERY CHARGER USING USB AND DIGITAL CAMERA HAVING THE SAME

[Brief Description of the Drawings]

FIG. 1 is a perspective view illustrating the front and upper surfaces of a typical digital camera;

FIG. 2 is a rear view of the digital camera of FIG. 1;

FIG. 3 is a view illustrating the configuration of the light incident side of the digital camera 1 of FIG. 1;

FIG. 4 is a block diagram illustrating the overall structure of the digital camera 1 of FIG. 1;

FIG. 5 is a perspective view illustrating a conventional mobile phone receiving power from a computer by USB;

FIG. 6 is a block diagram illustrating a method of supplying power to the mobile phone of FIG. 5;

FIG. 7 is a block diagram illustrating a battery charger using USB according to a preferred embodiment of the present invention;

FIG. 8 is a block diagram illustrating the inner structure of the USB battery charger of FIG. 7;

FIG. 9 is a circuit diagram of the charging portion of FIG. 7;

FIG. 10 is a view illustrating a digital camera connected to a computer by USB according to a preferred embodiment of the present invention; and

FIG. 11 is a block diagram illustrating the inner structure of the digital camera of FIG. 10 connected to the computer by USB.

< Explanation of Reference numerals designating the Major Elements of the Drawings >

71: USB battery charger
72: USB port of computer
73: battery
74: charging portion
75: controlling portion
76: USB controller
77: USB cable
78: main controller of portable electronic device

89: power converting portion

[Detailed Description of the Invention]

[Object of the Invention]

[Technical Field of the Invention and Related Art prior to the Invention]

The present invention relates to a battery charger using USB and a digital camera having the same, and more particularly, to a battery charger using USB installed in a portable electronic device, which is connected to a computer by USB and charges various types of batteries by receiving power from the computer through the USB, and a digital camera having the same.

Recently, use of portable electronic devices such as digital cameras has grown rapidly. The digital camera is connected to a universal serial bus (USB) port to transfer photographed image files to a computer or other storage medium. Typically, the USB port includes a pair of data ports for data transmission and a pair of power ports for connection to a power supply.

FIG. 1 is a perspective view illustrating the front and upper surfaces of a typical digital camera. FIG. 2 is a rear view of the digital camera shown in FIG. 1.

Referring to FIG. 1, a microphone MIC, a self-timer lamp 11, a flash 12, a shutter button 13, a mode dial 14, a function selection button 15, a photographing information display portion 16, a viewfinder 17a, a function block button 18, a flash light amount sensor 19, a lens portion 20, and an external interface portion 21 are arranged on the front and upper surfaces of a typical digital camera 1.

Referring to FIG. 2, a representative voice button 42, a speaker SP, a power button 31, a monitor button 32, an automatic focus lamp 33, a viewfinder 17b, a flash ready lamp 34, a display panel 35, a confirm/cancel button 36, an enter/play button 37, a menu button 38, a wide-angle zoom button 39w, a telephoto zoom button 39t, an up movement button 40up, a right movement button 40ri, a down movement button 40do, and a left movement button 40le are arranged on the rear surface of a typical digital camera 1.

FIG. 3 shows the configuration of the light incident side of the digital camera 1 of FIG. 1. FIG. 4 shows the overall structure of the digital camera 1 of FIG. 1. Referring to FIGS. 3 and 4, the overall structure of the digital camera 1 of FIG. 1 is described below.

An optical system OPS including the lens portion 20 and a filter portion 41 optically processes light from an object to be photographed. The lens portion 20 of the optical system OPS includes a zoom lens ZL, a focus lens FL, and a compensation lens CL.

When the user presses the wide-angle zoom button 39w of FIG. 6 or the telephoto zoom button 39t of FIG. 2 included in a user input portion INP, a signal corresponding to the pressed button is input to a microcontroller 512. Accordingly, as the microcontroller 512 controls a lens actuating portion 510. a zoom motor M_Z is actuated to move the zoom lens ZL.

The filter portion 41 of the optical system OPS includes an optical low pass filter OLPF which removes optical noise at a high frequency and an infrared cut filter IRF which cuts an infrared component of the incident light.

An optoelectric converting portion OEC of a CCD (charge coupled device) or a CMOS (complementary metal-oxide-semiconductor) converts light from the optical system OPS to an electric analog signal. A digital signal processor DSP 507 controls the operation of the optoelectric converting portion OEC and a CDS-ADC (correlation double sampler and analog-to-digital converter) device 501 as an analog-to-digital converting portion by controlling a timing circuit 502. The CDS-ADC device 501 processes the analog signal from the optoelectric converting portion OEC by removing high frequency noise and adjusting the amplitude thereof, to convert the processed analog signal to a digital signal. The digital signal processor DSP 507 processes the digital signal output from the CDS-ADC device 501 to generate a digital image signal divided into a brightness signal and a chrominance signal.

An illumination portion LAMP operated by the microcontroller 512 includes the self-timer lamp 11, the automatic focusing lamp 33 of FIG. 2, and the flash ready lamp 34 of FIG. 2. The user input portion INP includes the shutter button 13 of FIG. 1, the mode dial 14 of FIG. 1, the function selection button 15 of FIG. 1, the function block button 18 of the FIG. 1, the monitor button 32 of FIG. 2, the confirm/delete button 36 of FIG. 2, the enter/play button 37 of FIG. 2, the menu button 38 of FIG. 2, the wide-angle zoom button 39w of FIG. 2, the telephoto zoom button 39t of FIG. 2, the up movement button 40up of FIG. 2, the right movement button 40ri of FIG. 2, the down movement button 40do of FIG. 2, and the left movement button 40le of FIG. 2.

The digital image signal from the digital signal processor DSP 507 is temporarily stored in the DRAM (dynamic random access memory) 504. An EEPROM (electrically erasable programmable read only memory) 505 contains an algorithm and set data needed for the operation of the digital signal processor DSP 507. A user's memory card is detachably inserted in a memory card interface MCI 506.

The digital image signal from the digital signal processor DSP 507 is input to an LCD driving portion 514 so that an image is displayed on the display panel 35.

The digital image signal from the digital signal processor 507 can be transmitted in a serial communication by a USB (universal serial bus) connection portion 21a, or an RS232C interface 508 and a connection portion 21b. The digital image signal can be transmitted as a video signal through a video filter 509 and a video output portion 21c.

An audio processor 513 outputs a voice signal from the microphone MIC to the digital signal processor DSP 507 or a speaker SP and an audio signal from the digital signal processor 507 to the speaker SP. The flash 12 is driven by the microcontroller 512 and a flash controller 511 according to the signal from the flash light amount sensor 19.

Japanese Patent Publication No. 2001-125689 discloses a method and apparatus for supplying power to a portable electronic device using USB. In the patent, a secondary battery is charged by supplying power from a computer used as a host to a mobile phone corresponding to a peripheral using a USB port.

FIG. 5 is a view illustrating a conventional mobile phone receiving power from a computer by USB. FIG. 6 is a block diagram showing a method of supplying power to the mobile phone of FIG. 5.

Referring to FIGS. 5 and 6, a mobile phone 61 is connected to a computer 62 by USB. That is, a USB connection port 63 of the mobile phone 61 is connected to a USB connection port 64 of the computer 62 by a USB cable 65. The computer 62 receives power from a typical AC power source 67, for example, 220 V AC, through a power cable 66. Alternatively, the computer 62 may receive power through an adaptor 68 which converts AC power to DC power, for example, 5 V DC, used in the computer 62.

The connection between the computer 62 and the mobile phone 61 using the USB cable 65 is made by a pair of power ports and another pair of data ports. The USB connection port 63 of the mobile phone 61 includes a regulator 631 and a USB controller 632. The regulator 631 converts the power 4.5 V and GND received from

the computer 62 to a voltage used in the mobile phone 61 and supplies the voltage to a battery management system 69 in the mobile phone 61 so that the power needed for the mobile phone 61 to operate is supplied. The USB controller 632 is connected to the USB connection port 64 of the computer to input and output the data D+ and D- and to a main controller (not shown) of the mobile phone 61.

In typical portable electronic devices, such as digital cameras, various types of batteries such as nickel metal hydride (Ni-MH), nickel cadmium (NI-Cd), or lithium-ion (Li-ion) can be used, unlike devices such as mobile phones using Li-ion batteries only. The level of a charging voltage and a charging method are distinctively different according to the type of battery. Thus, appropriate charging conditions and methods must be applied according to the type of battery.

However, in mobile phones, since a fixed voltage drop of the USB port using a general regulator is performed, charging is not performed according to the type of battery. Thus, according to the method of charging only in the above simple voltage drop, the Li-ion battery may explode if the voltage thereof increases over a predetermined value, due to the characteristic of the Li-ion battery.

[Technical Goal of the Invention]

To solve the above and/or other problems, the present invention provides a battery charger using USB installed in a portable electronic device, which is connected to a computer by USB and can charge a variety of batteries by receiving power from the computer by USB, and a digital camera having the same.

[Structure and Operation of the Invention]

According to an aspect of the present invention, an apparatus for charging a battery of a portable electronic device connected to a computer by USB by receiving power from the computer through USB, the apparatus comprising a control portion to generate charge control signals corresponding to a battery selected according to a battery selection signal that is externally input, and a charging portion to charge the selected battery according to the charge control signals from the control portion.

The charge control signals of the control portion are a charge start signal to enable output of the charging portion, a battery type signal to control an output voltage level according to the battery selection signal, and a charge voltage control signal and a

charge current control signal which are generated by receiving a charge current and a charge voltage from the charging portion to control the charge current and the charge voltage.

The control portion is a main controller of the portable electronic device.

According to another aspect of the present invention, a digital camera connected to a computer by USB to charge a battery by receiving power from the computer through USB, the digital camera comprising a USB charger including a USB controller to transmit and receive data through a USB port of the computer, a control portion to generate charge control signals corresponding to a battery selected according to a battery selection signal that is externally input, and a charging portion to charge the selected battery according to the charge control signals from the control portion, a charging portion to charge at least one among the various types of batteries, a control portion to control a charging operation of the charging portion, a main controller to transmit and receive data with the USB controller, and a power converting portion to receive power from the battery that is charged by the charger and generate and output power having a plurality of voltage levels.

The charge control signals of the control portion are a charge start signal to enable output of the charging portion, a battery type signal to control an output voltage level according to the battery selection signal, and a charge voltage control signal and a charge current control signal which are generated by receiving a charge current and a charge voltage from the charging portion to control the charge current and the charge voltage.

Preferred embodiments of the present invention will now be described with reference to the attached drawings.

FIG. 7 is a block diagram illustrating a battery charger using USB according to a preferred embodiment of the present invention. FIG. 8 is a block diagram illustrating the inner structure of the USB battery charger of FIG. 7. FIG. 9 is a circuit diagram of the charging portion of FIG. 7.

Referring to FIGS. 7, 8, and 9, a USB battery charger 71 mainly includes a charging portion 74 and a controlling portion 75. The USB battery charger 71 charges a battery 73 of a portable electronic device, which is connected to a computer by USB by receiving power from the computer by the USB.

The USB battery charger 71 is connected to a USB port 72 of the computer by a USB cable 77. The USB cable 77 is preferably formed of a pair of power connection lines 5 V and GND and a pair of data connection lines +D and -D, like a typical USB cable.

The charging portion 74 charges one among various types of batteries which is installed and preferably controlled by the control portion 75 while being connected to the control portion 75 and transceiving various signals therebetween. However, the charging portion 74 can be configured without the control portion 75 according to the structure of a circuit portion constituting the charging portion 74.

The control portion 75 is connected to a main controller 78 of the portable electronic device and receives a battery selection signal through the main controller 78. The battery selection signal can be input by a user or recognized by a battery recognition apparatus which is additionally provided.

The control portion 75 connected to the charging portion 74 controls a charging operation of the charging portion 74. Alternatively, the main controller 78 of the portable electronic device, to which the USB battery charger 71 is connected, can be used as the control portion 75.

A USB controller 76 connected to the computer USB port 72 by the USB cable 77 controls the input/output of data D+ and D- between the main controller 78 of the portable electronic device and the computer. For a digital camera, obtained image data can be transmitted between the computer and the digital camera. The battery 73 charged by the USB battery charger 71 supplies power to the portable electronic device so that the portable electronic device can operate using the power.

Various input and output ports are formed in each of the control portion 75 and the charging portion 74 so that various signals are transmitted between the control portion 75 and the charging portion 74. The control portion 75 receives a detected charge voltage, a detected charge current, a reset signal, and control portion power, from the charging portion 74. The charging portion 74 receives a charge start/end signal, a cell number signal, a battery type signal, and a charge current/voltage control signal from the control portion 75.

The control portion 75 outputs the charge start signal and the battery type signal to the charging portion 74 to initiate charging of the battery 73. Also, the control portion 75 receives the detected charge current and the detected charge voltage from

the charging portion 74 and generates a charge voltage control signal and the charge current control signal to be output to the charging portion 74. Thus, the charging portion 74 charges the battery 73 according to the type of battery installed.

The control portion 75 preferably includes at least one analog-to-digital converter (ADC) to receive an analog type detected charge voltage and detected charge current from the charging portion 74 and process the same in the control portion 75.

The control portion 75 preferably includes a plurality of typical input/output (I/O) ports to output the charge start/end signal, the cell number signal, and the battery type signal. Also, the control portion 75 preferably includes a pulse with modulation and digital-to-analog converter (PWM/DAC) to receive and process the detected charge voltage and the detected charge current from the charging portion 74 and outputs the charge voltage control signal and the charge current control signal to a VSET port and an ISET port of the charging portion 74.

Further, the control portion 75 operates by receiving power through a power port V_{DD}, which is generated by receiving USB input power from a linear regulator LDO of the charging portion 74 shown in FIG. 9, and charging a voltage level of the USB input power, and output through a power output port VL.

According to the present invention, a battery in a portable electronic device is charged by receiving power, through USB, from a computer that is a host. Thus, the battery can be charged anywhere there is the computer, without a charger using regular power.

Various types of batteries, such as lithium-ion, nickel metal hydride, or nickel cadmium, can be charged stably and efficiently by receiving power through USB in a method of charging various types of batteries included in the portable electronic device appropriate to their characteristics.

Referring to FIG. 9, the USB battery charger 71 of FIG. 8 includes the charging portion 74 and receives USB input power, for example, 5 V in the present preferred embodiment, and generates a constant voltage output of 3.3 V to charge the battery 73. The battery 73 may be one of the various types of batteries, such as nickel metal hydride, nickel cadmium or lithium-ion, and can be charged by the charging portion 74 in an appropriate condition according to the battery type.

The charging portion 74 preferably has three blocks including a linear regulator (low dropout linear regulator (LDO)) 741, a reference voltage generating portion 742,

and a voltage/current regulator. The linear regulator 741 is a linear regulator having a 3.3 V output VL. The output VL is used as power for the control portion 75 or other devices and the output port of VL has a function of preventing short-circuit.

The reference voltage generating portion 742 detects and supplies a more accurate voltage to charge a lithium-ion battery which can possibly explode. The reference voltage generating portion 742 can be embodied in a manner of distributing a voltage into an internal 2% 20K resistor and an external resistor R_{VSET}. This is important for the life span of the lithium-ion battery and optimal capacity.

The voltage/current regulator, which is widely distributed in the charging portion 74, preferably includes an attenuator, a current sense amplifier (CSA), a voltage regulation loop compensator (CCV), and a current regulation loop compensator (CCI).

The attenuator externally sets the number of cells of batteries input through a predetermined port CELL2 from the control portion 75. The current sense amplifier detects the current of the battery from an external detection resistor R_{CS} and an external load resistor R_{ISET} to perform various operations with other function blocks. The charge current is determined by the detection resistor R_{CS} and the load resistor R_{ISET}.

Each of the voltage regulation loop compensator and the current regulation loop compensator forms a separate loop to individually compensate for voltage and current by using external capacitors C1 and C2 connected to CCV port and CCI port, respectively, so that a charge can be stably performed. Each of the loops is completed by a P channel field effect transistor MOSFET or a PNP transistor (TR) connected externally.

CS+ and CS- are ports to detect current, DCIN is a port to receive USB input power, BATT is a battery power output port, ON is a port to receive a charge start/end signal from the control portion 75, CELL2 is a port to receive cell number signal of a battery to be charged, and OFFV is a port to receive the battery type signal.

FIG. 10 is a view illustrating a digital camera connected to a computer by USB according to a preferred embodiment of the present invention. FIG. 11 is a block diagram illustrating the inner structure of the digital camera of FIG. 10 connected to the computer by USB.

Referring to FIGS. 10 and 11, a digital camera 8 having the USB battery charger 71 is connected to the computer 62 by USB to charge the battery 73 by receiving power from the computer 62 through a USB cable and includes the USB battery charger 71,

the main controller 78, and a power converting portion 89. Since the constituent elements having the same reference numbers as those described with reference to FIGS. 7 through 9 are the same constituent elements and have the same functions, detailed description thereof will be omitted.

The USB battery charger 71 includes the USB controller 76, the charging portion 74, and the control portion 75. The USB controller 76 transmits and receives data through the USB port of the computer. The charging portion 74 charges at least one of the various types of batteries. The control portion 75 controls the charging operation of the charging portion 74.

The main controller 78 controls the overall operation of the digital camera 8 by transceiving data with the USB controller 76. The power converting portion 89 receives power from the battery 73 charged by the USB battery charger 71 and generates and outputs power having a plurality of voltage levels.

The power converting portion 89 includes a regulator 891 and a DC/DC converter 892 to generate voltages having various levels needed by the digital camera 8. Power generated from the power converting portion 89 is supplied to various portions needing power such as a power supply portion 91 for a main controller 78, an LCD driver 92, a motor driver 93, a DC/DC converter 94, and a CCD driver 95.

[Effect of the Invention]

As described above, according to the USB battery charger and the digital camera having the same according to the present invention, a battery in a portable electronic device is charged by receiving power, through USB, from a computer that is a host. Thus, the battery can be charged anywhere there is the computer, without a charger using regular power.

Also, various types of batteries can be charged stably and efficiently by receiving power through USB in a method of charging various types of batteries included in the portable electronic device, such as lithium-ion, nickel metal hydride, or nickel cadmium, appropriate to their characteristics.

While this invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. An apparatus for charging a battery of a portable electronic device connected to a computer by USB by receiving power from the computer through USB, the apparatus comprising:

a control portion to generate charge control signals corresponding to a battery selected according to a battery selection signal that is externally input; and

a charging portion to charge the selected battery according to the charge control signals from the control portion.

2. The apparatus as claimed in claim 1, wherein the charge control signals of the control portion are a charge start signal to enable output of the charging portion, a battery type signal to control an output voltage level according to the battery selection signal, and a charge voltage control signal and a charge current control signal which are generated by receiving a charge current and a charge voltage from the charging portion to control the charge current and the charge voltage.

3. The apparatus as claimed in claim 1, wherein the control portion is a main controller of the portable electronic device.

4. A digital camera connected to a computer by USB to charge a battery by receiving power from the computer through USB, the digital camera comprising:

a USB charger including a USB controller to transmit and receive data through a USB port of the computer, a control portion to generate charge control signals corresponding to a battery selected according to a battery selection signal that is externally input, and a charging portion to charge the selected battery according to the charge control signals from the control portion;

a charging portion to charge at least one among the various types of batteries;

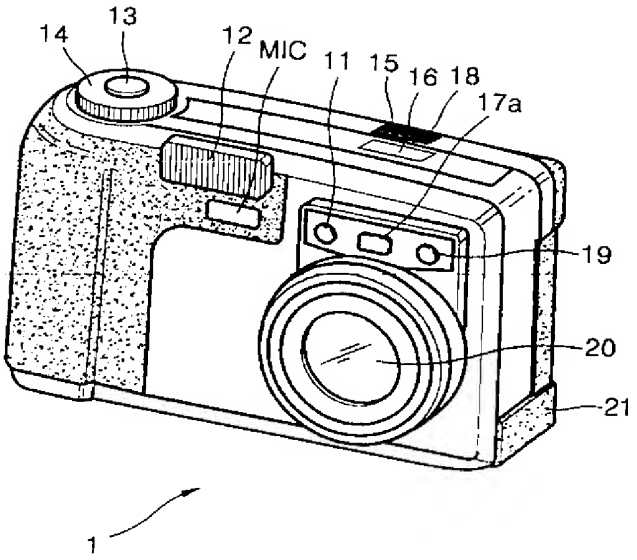
a control portion to control a charging operation of the charging portion;

a main controller to transmit and receive data with the USB controller; and

a power converting portion to receive power from the battery that is charged by the charger and generate and output power having a plurality of voltage levels.

5. The digital camera as claimed in claim 4, wherein the charge control signals of the control portion are a charge start signal to enable output of the charging portion, a battery type signal to control an output voltage level according to the battery selection signal, and a charge voltage control signal and a charge current control signal which are generated by receiving a charge current and a charge voltage from the charging portion to control the charge current and the charge voltage.

FIG. 1


14
13
12
MIC
11
15
16
18
17a
19
20
21
1

5

FIG. 2

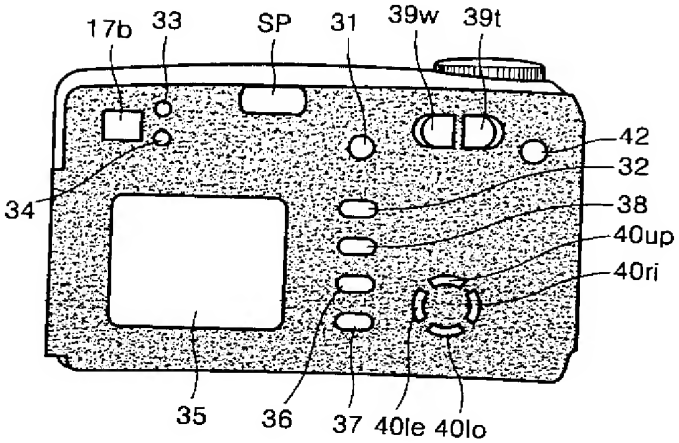

17b
33
SP
31
39w
39t
42
32
38
40up
40ri
34
35
36
37
40le
40lo

FIG. 3

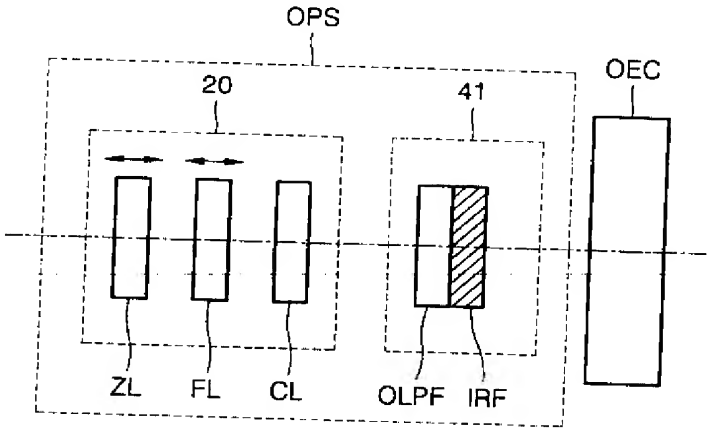


FIG. 4

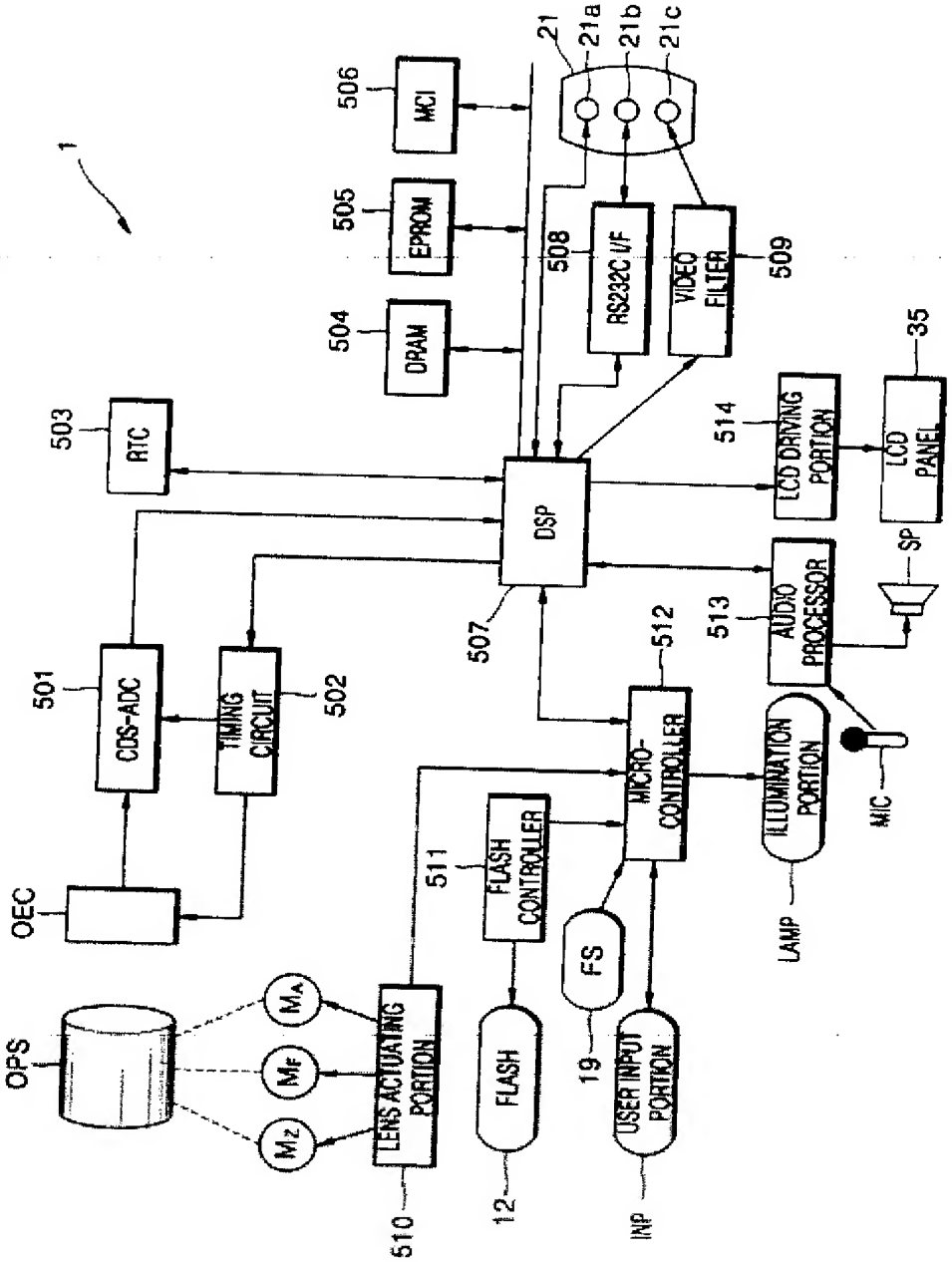

1
21
21a
21b
21c
506
MCI
505
EPROM
504
DRAM
508
RS232C I/F
509
VIDEO FILTER
503
RTC
514
LCD DRIVING PORTION
35
LCD PANEL
DSP
SP
507
513
AUDIO PROCESSOR
512
501
CDS-ADC
502
TIMING CIRCUIT
MICRO-CONTROLLER
ILLUMINATION PORTION
MIC
OEC
511
FLASH CONTROLLER
FS
LAMP
OPS
M_A
M_F
M_Z
LENS ACTUATING PORTION
FLASH
19
USER INPUT PORTION
510
12
INP

FIG. 5

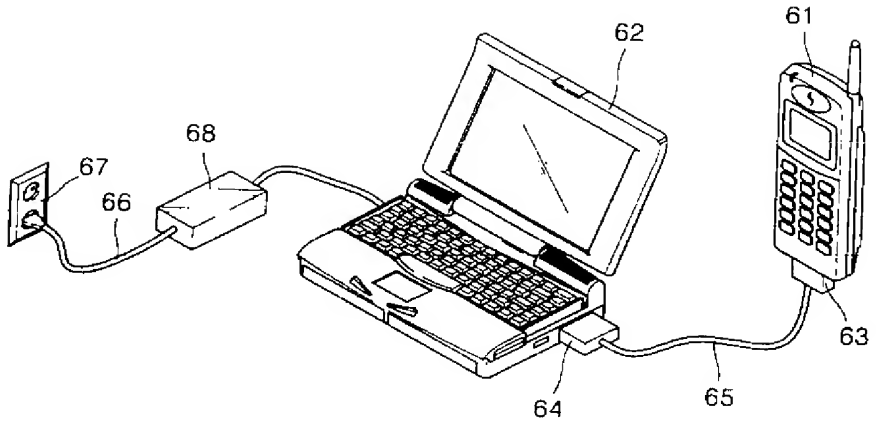

61
62
68
67
66
63
64
65

FIG. 6

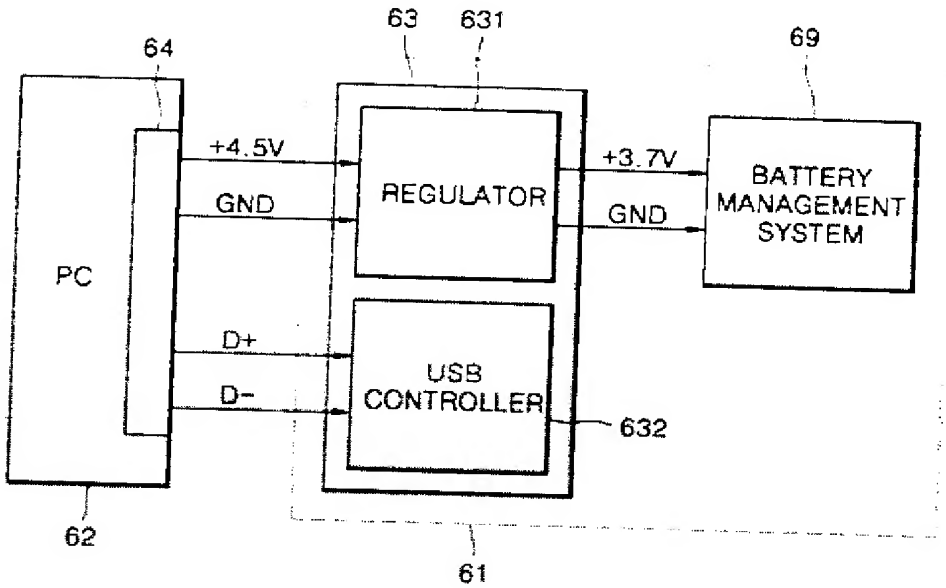

63
631
64
69
+4.5V
GND
REGULATOR
+3.7V
GND
BATTERY MANAGEMENT SYSTEM
PC
D+
D-
USB CONTROLLER
632
62
61

FIG. 7

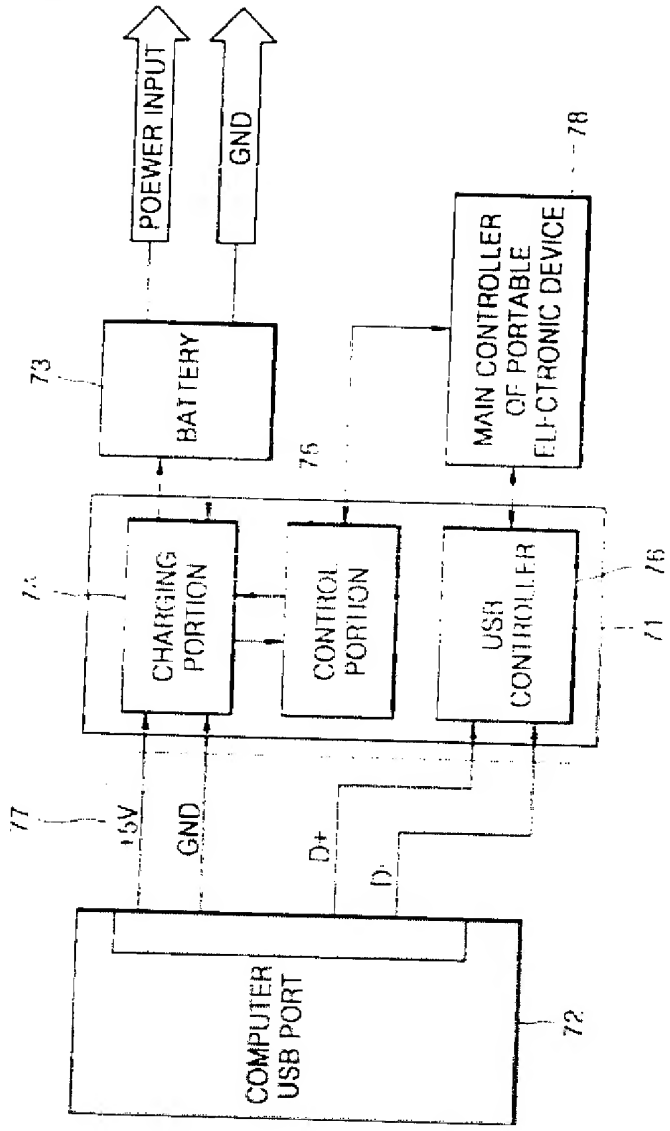

POEWER INPUT
GND
73
BATTERY
MAIN CONTROLLER OF PORTABLE ELECTRONIC DEVICE
78
CHARGING PORTION
CONTROL PORTION
USB CONTROLLER
77
5V
GND
D+
D-
COMPUTER USB PORT
72

FIG. 8

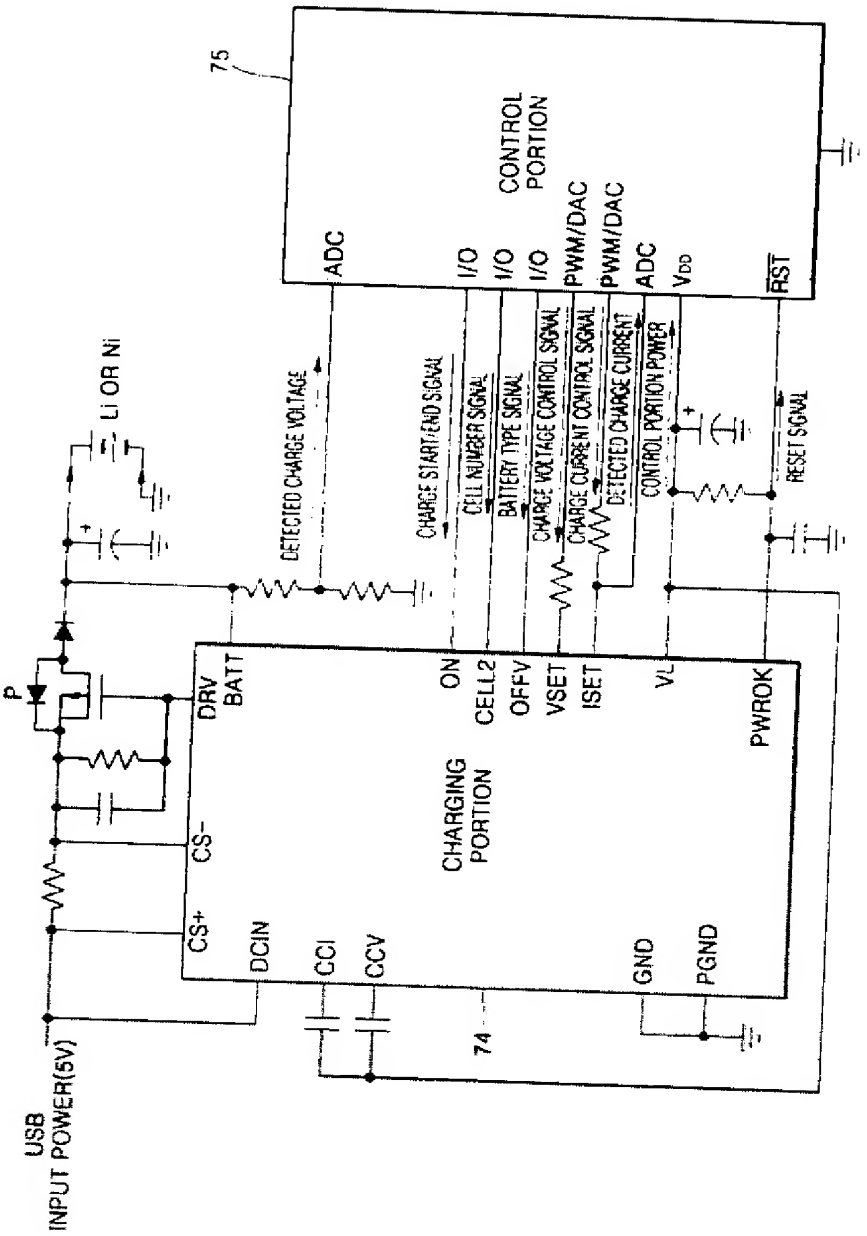

75
CONTROL PORTION
ADC
I/O
I/O
I/O
PWM/DAC
PWM/DAC
ADC
VDD
RST
DETECTED CHARGE VOLTAGE
CHARGE START/END SIGNAL
CELL NUMBER SIGNAL
BATTERY TYPE SIGNAL
CHARGE VOLTAGE CONTROL SIGNAL
CHARGE CURRENT CONTROL SIGNAL
DETECTED CHARGE CURRENT
CONTROL PORTION POWER
RESET SIGNAL
Li OR Ni
P
DRV
BATT
CS-
CS+
DCIN
CCI
CCV
CHARGING PORTION
ON
CELL2
OFFV
VSET
ISET
VL
PWROK
GND
PGND
74
USB
INPUT POWER(5V)

FIG. 9

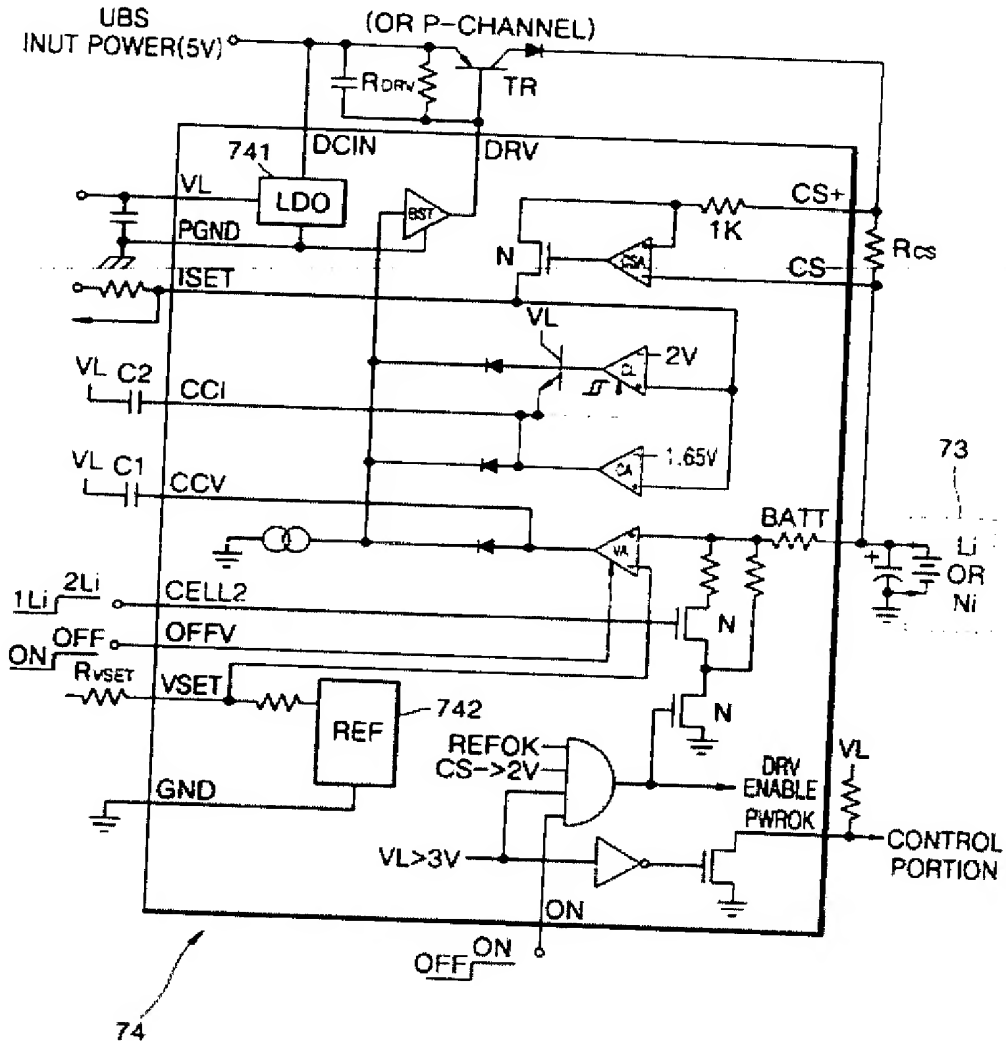

UBS
INUT POWER(5V)
(OR P-CHANNEL)
RDRV
TR
741
DCIN
DRV
VL
LDO
PGND
ISET
CS+
1K
N
CSA
CS-
Rcs
VL
2V
VL C2
CCI
1.65V
VL C1
CCV
73
BATT
Li
OR
Ni
1Li 2Li
CELL2
ON OFF
OFFV
RVSET
VSET
REF
742
N
N
REFOK
CS->2V
DRV
ENABLE
PWROK
VL
CONTROL
PORTION
GND
VL>3V
ON
OFF ON
74

FIG. 10

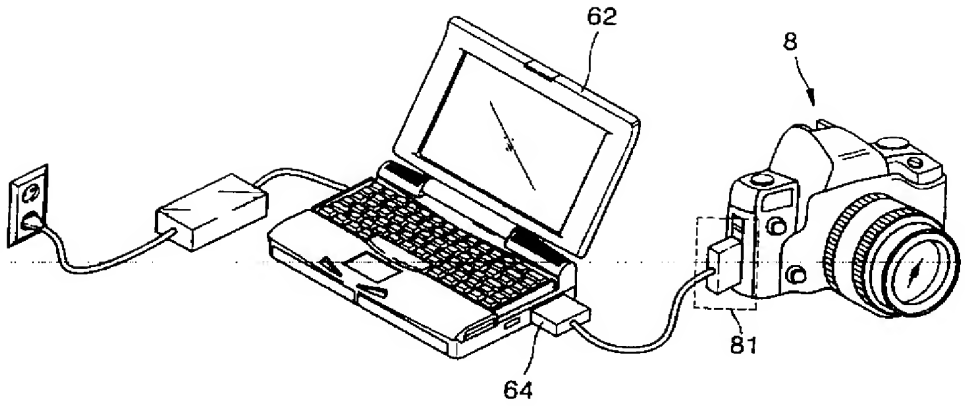
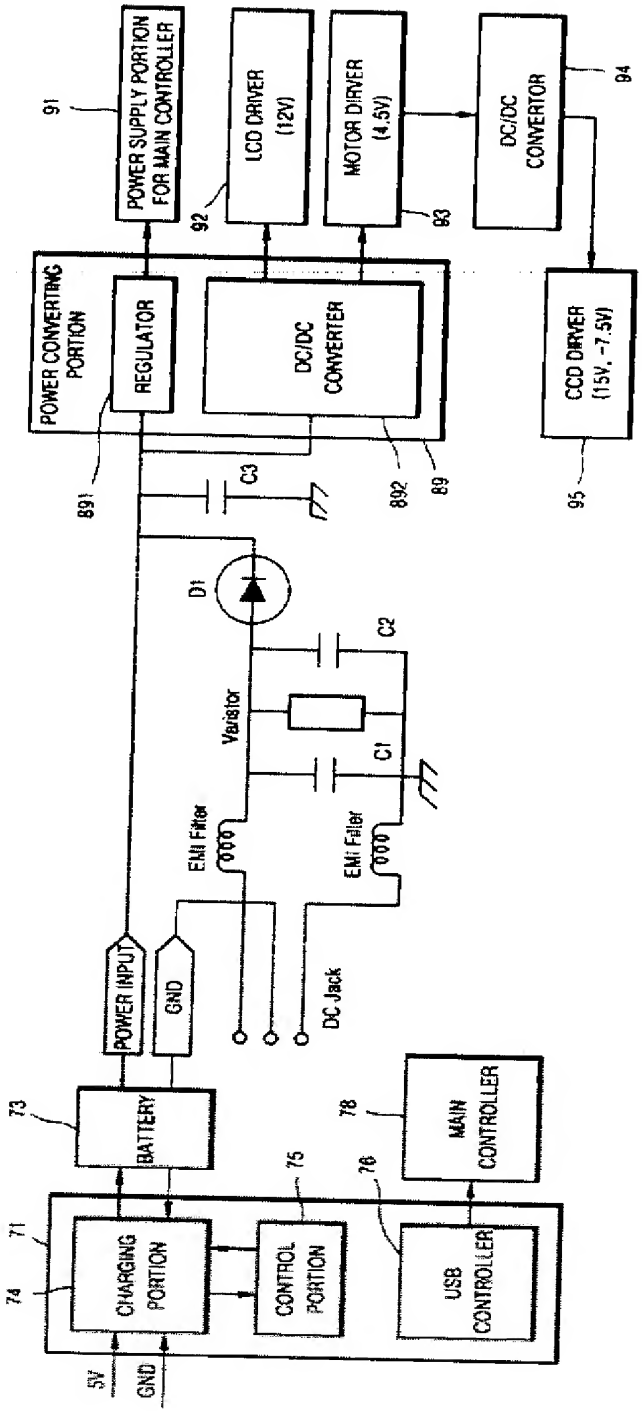


FIG. 11


91
POWER SUPPLY PORTION FOR MAIN CONTROLLER
92
LCD DRIVER (12V)
MOTOR DIRVER (4.5V)
93
DC/DC CONVERTOR
94
POWER CONVERTING PORTION
REGULATOR
DC/DC CONVERTER
CCD DIRVER (15V, -7.5V)
891
892
89
95
C3
D1
C2
Varistor
C1
EMI Filter
EMI Filter
POWER INPUT
GND
DC Jack
73
BATTERY
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MAIN CONTROLLER
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CHARGING PORTION
CONTROL PORTION
USB CONTROLLER
5V
GND